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gained an immunity or idiosyncrasy to miasmatic influences by generations of adaptation. He has made little progress in civilization. This is due to the lack of inherent capability of the negro type more than any other cause. The lack of harbors on the coasts of Africa has always and will in the future militate against the settlement and growth by advanced races. It looks now as if this continent, vast in wealth and area, is becoming overrun by the fierce disciples of Islam, the most undesirable settlers possible, and in whose hands it will be lost in an irreclaimable darkness. Another great bane to the Congo and all Africa is the accursed slave-trade. For over three thousand years she has bartered her children to be slaves over the whole earth. Livingstone, Schweinfurth, Stanley, and many other distinguished explorers have seen, with anguish, this comprehensive atrocity in all its phases, and have tried to perfect plans for putting it down. The Congo Free State, through Henry Stanley, has done much to suppress this evil. That recent brilliant master-stroke of enlisting Tippu Tib, the prince of slave-traders, against the slave-trade cannot receive too much praise, and it is to be hoped that, as another laurel in Stanley's crown, he may successfully rescue Emin Bey, the soldier-scientist, from his perilous position in the heart of Africa, and restore him, with his large collections, to the civilized world.

NOTES ON CLASSIFICATION AND NOMENCLATURE FOR THE AMERICAN COMMITTEE OF THE INTERNATIONAL GEOLOGICAL CONGRESS, MARCH, 1887.

BY N. H. WINCHELL.

THE PALÆOZOIC.—In the light of recent work done in the classic region of American geology, Eastern New York, by Messrs. Ford and Walcott, reviving some of the old questions that separated the geologists of forty years ago into widely variant schools, it becomes appropriate for this committee to earnestly and justly weigh the facts so far as they bear on the choice of names for recommendation to the next congress.

It will have to be admitted that the scheme of stratigraphy

which was erected by Mr. Emmons, including formations that extended eastward into Massachusetts and Vermont, and westward to the Hudson River, covering a series of strata from the gabbros of the Adirondacks to the top of the Lorraine shales, has been overthrown by the researches of Dana and his colleagues,—in other words, that the “Taconic System,” as constructed by Dr. Emmons, cannot be maintained.

On the other hand, the Taconic rocks, in which Emmons found primordial fossils, and to which he extended the name which he applied to his system, have been found to have a wide extension and a great thickness, as well as a characteristic fauna. The initial point of divergence between him and his colleagues on the New York survey was as to the existence of such pre-Potsdam strata. From this initial point he built up a system without warrant. He laid a true foundation, but his superstructure was not well built. In consequence of a poor superstructure, the tendency has been strong to sweep away also his foundation, denying to both of them the right to existence in geological nomenclature.

The question that comes before this committee is to determine by what designation the strata shall be known that contain the foundation-rocks of the “Taconic System” of Emmons,—those that really are stratigraphically pre-Potsdam.

Recent palæontological researches and work in the field show that the pre-Potsdam fauna pervades a belt of rocks that extends from Northern Vermont southward, by way of Georgia, Vermont, Bald Mountain, New York, Schodack Landing, to Stockport, Columbia County, east of the Hudson River, comprising a thickness of strata amounting to about four thousand feet. It is also reasonable to suppose that it constitutes the basal portion of the range of the Taconic Mountains, and perhaps a large part of the range in some places. It is therefore not inappropriate to consider the claim of Dr. Emmons to give name to this belt.

(a) TACONIC *versus* PRIMORDIAL.

The term *primordial*, adopted by Barrande for the first fauna, is more comprehensive than the fauna that was discovered by Emmons in these Taconic strata. But Barrande distinctly acknowledges that Dr. Emmons antedated him in the discovery and advocacy of a fossil horizon belonging in the primordial

zone. There can be no question, when the author of the term primordial makes such an admission, that, other things being equal, the term first used should be perpetuated. But it may be stated that other things were not equal. They were not equal in the thoroughness with which the fauna was investigated, nor the correctness with which the stratigraphic relationships were stated, nor in the limitations which were placed on its extent. They were not equal in the comprehensive, uninterrupted progress with which the respective investigations were carried on on different sides of the Atlantic, nor the completeness and costliness of publication. But it may be doubted whether any of these differences, or all of them, would warrant the unqualified adoption of the European term, to the exclusion of the American, against the right of priority for the American geologist. Emmons did, it seems to me, all that was required, or that is now required, to establish his claim to the discovery of a new formation. He defined it geographically, stratigraphically, and palæontologically. No one else in America has applied any new name to it. It came in conflict, it is true, with another American designation, but no one now will urge the correctness of that opposing term. As between *Taconic* and *primordial*, both authors may be recognized and honored by confining the term Taconic to the identical horizon, or sub-fauna, in which it was described by Dr. Emmons, allowing the term primordial to embrace, as intended by Barrande, all the sub-faunas of the first fauna.

The first (oldest) sub-fauna is characterized by the genus *Paradoxides*.

The second sub-fauna is characterized by *Olenellus*.

The third sub-fauna is characterized by *Dicelocephalus*.

(b) TACONIC *versus* CAMBRIAN.

But we cannot overlook the fact that in Europe, and also in America, the term Cambrian is very generally applied to this fauna and the formation in which it is embraced, to the exclusion of both *Taconic* and *primordial*. This is a very singular circumstance. The reaction which set in to do justice to Sedgwick had such momentum that it swept over its own bounds and became itself an agent of injustice.

If the question of the relative dates at which the terms Taconic

and Cambrian were first used be brought to bear on this investigation, the facts will be found to be about as follows :

Murchison says the term Cambrian was first used in print in 1836, but Sedgwick says he had been at work on the formation since 1831, his first description being made and published in brief in the *Proceedings of the British Association for the Advancement of Science* in 1832. In 1855 he also says he had made no material changes in the Cambrian since 1832, except some minor transpositions of stratigraphy. All this time the lower portion of these rocks was considered non-fossiliferous, Sedgwick not being willing even to admit the verity of fossils belonging to the primordial fauna in any of the rocks of his series. It is a singular fact that, although Mr. E. Davis discovered fossils in the rocks of the Cambrian in 1845, and had re-examined the locality with Mr. Sedgwick in 1846, and announcement of the discovery was made the same year, yet the English geologists did not know, or would not admit, that the primordial fauna of Barrande was contained in the rocks of the Cambrian till 1851, when Barrande visited the Woodwardian Museum, and examined also the collections of the survey; and even then they would not admit it till they had sent some of their own officers over the ground which they had considered finally examined, and these had returned with a convincing collection of primordial fossils.

Barrande's *notice préliminaire* of the primordial fauna of Bohemia was issued in 1846, two or three years after the discovery of primordial fossils in the Taconic, and five years before the discovery of primordial fossils in the Cambrian.

It appears, therefore, that as a formation of rocks, without reference to geological age or relation to other formations, the Cambrian was studied by Sedgwick four years before Emmons began official work on the New York survey; that the term Cambrian was used as a designation for the formation which Sedgwick was engaged on in 1835; and that Emmons used the term Taconic officially first in his volume dated 1842. Emmons was, however, at work incidentally on the Taconic rocks much earlier. Professor Dewey mentions a mineral found by him and analyzed in 1820 (*Am. Jour.*, (i.) ii. 249). Professor Dewey uses the *Taconic range* as a geological entity, and the rocks of the range as a starting-point, in his "Geological Section from Williamstown to the City of Troy," published in 1820. The term

was first used by him in a geological article dated January 27, 1819. Lee, Hitchcock, Emmons, Dewey, Barnes, Briggs, and Eaton, between 1819 and 1842, frequently use the term in their geological papers. They considered the rocks extending from the western towns of Vermont and Massachusetts westward to the Hudson River as constituting a group different from those farther east, and set off by geological distinctions so markedly that they could not be confounded. Sometimes these rocks were referred to as the *rocks of the Taconic range*, sometimes as *transition rocks*, and sometimes as the *metamorphic group*. But that they were a single group, *en masse*, was not questioned, either by the friends or the opponents of the Taconic system, as late as 1844, Eaton having gone so far as to place them below the strata of the New York system.

Used, then, as a datum of geological reckoning, "the rocks of the Taconic range" date from 1819, but it was not till 1842 that Dr. Emmons erected these into a geological group and formally announced the "Taconic System."

The foregoing facts may be tabulated as below :

	Used as a Faunal Designation.	Used in Geological Literature.	Used as Name of a Zone or System.
Primordial.....	1846	1846	1846
Cambrian.....	1853	1836	1836
Taconic	1844	1819	1842

In thus calling attention to the use of the term Taconic in geological literature as early as 1819, the objection will naturally arise in the minds of some of the committee that the term was used wholly as a geographic and not as a geological one, and hence that it has no claim in geological nomenclature. While there is some force in this objection, yet, if the nature of the papers written by the earlier geologists be examined into, it will be seen at once that the term was used both in a geographic and in a geological sense. Professor Dewey, in 1820, giving his *geological section from the Taconic range to Troy, N. Y.*, says distinctly that the same rock-formation which constitutes the range at Williamstown extends to the Hoosac Valley, and gives place to a chlorite slate, which, since it is also found in the Taconic range, "ought to be considered as belonging to the range, and as the rock into which the talcose slate passes." From here he continues the section through graywacke rising into the hills at

Petersburg, constituting the mountains of Grafton, and extending as a general rock to Troy, where it is succeeded by a stratum of argillaceous slate, which extends to the banks of the Hudson.

In a general way this group of rocks is referred to as the "metamorphic series," or "transition series," as well as *the rocks of the Taconic range*, by other geologists up to 1842. As a geological designation it had no more force than the terms used by Sedgwick when he referred to the rocks of the Malvern Hills, or of the Longmynd Hills, or the term that was at first used to express the formation of the Helderberg Mountains in New York. In those early days of the century geologists made their designations refer to mineralogical and lithological characters rather than to systematic stratigraphy. Geographic designations had not yet been introduced with the authoritative endorsement of Murchison. There was but imperfect knowledge of systematic stratigraphy; but geographic terms were converted, by an easy scale of varying terminology, into geological terms. The "rocks of the Longmynd" became thus the *Longmynd rocks*. The rocks of the Helderberg Mountains became thus the upper and lower Helderberg rocks; and Mr. Emmons sagaciously chose to erect the rocks of the Taconic range into the Taconic system.

It is customary to date the "Taconic System" from the year 1842, when it was officially announced by Dr. Emmons, and it is just to give the term Taconic its full right as a distinct term in geological nomenclature only after that date, parallel with a similar use of the term Cambrian; but it cannot be questioned that the term Taconic was a semi-geologic term for at least twenty years before.

It may next be asked, What was the intent of the authors of these names? In the absence of perfectly conclusive evidence as to the historic priority of one, in all respects, over the others, when the facts seem to have a divided and variant significance, this may be the only way in which a just conclusion can be reached. It is not necessary to enter upon the citation of facts or quotation of authorities. The following conclusion, so far as Mr. Barrande is concerned, will hardly be questioned. *He worked to elaborate a fauna, and when that was established he denominated the strata the primordial zone.* In doing this he went no farther back than 1846.

In respect to Mr. Sedgwick, he worked on a series of rocks which he thought pertained to a single system, and illustrated it by fossils. These proved to be, for the most part, species of the Bala group, consisting of the second fauna. What few primordial fossils he found he placed within the same fauna. He claimed this fauna and this system of rocks as his Cambrian. This was named in 1836. It was no error of his that subsequently his term was crowded downward and removed from the rocks of the second fauna, and made to cover only a fauna of which he knew nothing. In other words, *the author of the Cambrian intended to include in his system only the rocks containing the second fauna.* Still, his stratigraphic scheme embraced lower beds.

In respect to the intention of Mr. Emmons, he worked on a series of rocks which he claimed was lower than the New York system. He announced a fauna which he intended to illustrate his system. The strata which he included in his system have been proved to contain his alleged fossils, and they pertain to a horizon below the New York system. All rocks known by him to contain fossils of the second fauna occurring within the general Taconic area were exempted by him from the Taconic system. *His main intention, both stratigraphic and palæontologic, therefore, was to include the rocks of the primordial fauna in his system.*

On the question of priority, therefore, the inquiry is reduced to the conflict between Cambrian and Taconic, with the Taconic having two counts to the Cambrian one.

On the question of the relative validity of those counts, the Taconic has that of correctness of palæontological identification and that of use in geological literature, which are very strong, while the Cambrian has that of formal announcement as a system.

On the question of the intention and claim of the author, the Taconic was correct in stratigraphy and palæontology when applied to the *first fauna*, and incorrect when applied by its adversaries to the second fauna. The Cambrian was correct in palæontology, and was not corrected by its author in stratigraphy when applied to the *second fauna*, and is incorrect in both respects when applied by its friends to the first fauna.

If the errors be eliminated, on each side, the first fauna should

be assigned to the Taconic and the second to the Cambrian. This will, of course, require the restriction of the term Silurian to the rocks of the *third fauna*, or to as much of it as was at first covered by that term, as argued by Hunt, Marcou, Rogers, Dawson, Jukes, and others.

The weight of authority and of usage has been in favor of covering the rocks in dispute between Murchison and Sedgwick, so far as they both claim strata holding the second fauna, by the Murchisonian term. Of the merits of this controversy I have nothing to say. It may fairly be left to the English geologists to decide. It would be an easy adjustment of all the conflicting claims, however, to assign, *pro honoris causa*, the first fauna to Emmons, the second to Sedgwick, and the third to Murchison.

THE ARCHÆAN.—It is my individual opinion that no subdivisions of the Archæan can be made, with an approach to probable acceptance and long-continued usefulness, at the present time. It would be judicious to introduce some indeterminate, non-descriptive terms, such as *Archæan No. 1* and *Archæan No. 2*, or *Archæan No. 3*, which could be interpreted by each locality, and applied by the geologists of each country, according to individual preference. In the Northwest, including Wisconsin, Minnesota, and Manitoba, much is now being done on the systematic study in the field of these rocks, and, without saying that the recognized, usual subdivision into Huronian and Laurentian is not valid in very large areas, it is true that, as a general scheme, this simple nomenclature is not applicable. I speak of these rocks as "Archæan" because of the general use of that designation. The terms *azoic* and *eozeic* may have prior rights, and, perhaps, ought to be used instead.